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with pleasure the Seed Catalogue, issued by Damman & Co., of San Giovanni a Teduccio (near Naples), Italy. Botanic gardens can secure many desirable plants from this catalogue.——The first number of Cooke's British Desmids has just come to hand. It resembles in text and plates the well-known "British Fresh-water Algæ," by the same author. It is to be completed in about ten parts, including all told about eighty plates, and will cost about twelve or thirteen dollars.

ENTOMOLOGY.

A New Arrangement of the Orders of Insects.—In preparing for the press our larger "Zoölogy," also in our "First Lesson in Zoölogy," which has just appeared from the press, we have admitted sixteen instead of eight orders of insects heretofore recognized by us. Below is given a very brief synopsis, prepared for popular use, of this class of insects. The Pseudoneuroptera as the result of farther examination and reflection, are dismembered into the Platyptera (which was characterized in the Third Report U. S. Entomological Commission), the Odonata and the Plectoptera. The latter name is proposed for the May-flies or Ephemeridæ, which we are disposed, with Brauer, to regard as a distinct order, and for which no suitable ordinal name has been hitherto proposed. The same is the case with the Mecaptera, a name proposed for the Panorpidæ, referred, we think, with justice, by Brauer, to a distinct order. Our reasons for this change in classification we hope to present on a future occasion.

Orders of Insects.

1.	Wingless, often with a spring	*Thysanura:* Spring-tails, etc.
2.	Fore wings minute, elytra-like	*Dermaptera:* Earwig.
3.	Wings net-veined; fore wings narrow; hind wings folded	*Orthoptera:* Locusts, Grasshoppers.
4.	Four net-veined wings; mouth-parts adapted for biting	*Platyptera:* White Ants, Bird-lice.
5.	Wings, net-veined, equal	*Odonata:* Dragon-flies.
6.	Wings net-veined, unequal	*Plectoptera:* May flies.
7.	Mouth beak-like, but with palpi	*Thysanoptera:* Thrips.
8.	Mouth-parts forming a beak for sucking; no palpi	*Hemiptera:* Bugs.
9.	Wings net-veined; metamorphosis complete	*Neuroptera:* Lace-winged Fly, etc.
10.	Wings long and narrow	*Mecaptera:* Panorpa.
11.	Wings not net-veined	*Trichoptera:* Caddis-fly.
12.	Fore wings sheathing the hinder ones	*Coleoptera:* Beetles.
13.	Wingless, parasitic	*Siphonaptera:* Flea.
14.	One pair of wings	*Diptera:* Flies.
15.	Four wings and body scaled	*Lepidoptera:* Butterflies.
16.	Four clear wings; hinder pair small; a tongue	*Hymenoptera:* Bees, Wasps, etc.

—*A. S. Packard.*

Luminous Organs of Mexican Cucuyo.—Carl Heinemann, of Vera Cruz, publishes in *Archiv f. Mikr. Anat.*, xxvi, 296 (June, 1886), extended observations on several species of the Cucuyo (Pyrophorus). Each beetle has three lamps, a pair of smaller dorsal lamps on the prothorax near its margin, and a large ventral lamp on its abdomen. The organs are developments of the hypodermis, are largest in the male, and the abdominal one is so thin and transparent that we can see the ventral nerve-cord through it. Branches of the trachea end in the luminous cells; they are bordered by such cells, but no end-cell on the trachea could be made out. Internal to the luminous layer is a non-luminous layer, formed by tracheal branches and irregular cell-masses, specially rich in urates. Though the light is usually nocturnal, yet if the animal is disturbed by day it will shine less brilliantly. Even a sleeping cucuyo will show in a dark chamber a mild light from the dorsal organs; the light of the abdominal organ cannot then be seen, as the insect rests with its abdomen doubled up against its sternum. If at such time we awake it, the breathing begins, whereon the light appears in its splendor. There are two kinds, or rather two degrees, of luminosity, one soft, the other bright, which may be termed respectively the cell-light and the tracheal-light. One may change into the other just as the dull glare of a smith's coals will on the action of the bellows develop into a bright flame. In the abdomen the lateral parts begin earliest to shine, and retain their luminosity the longest, because they occupy the place nearest the lateral tracheal trunks. During flight the abdominal organ is in constant activity (here differing from Lampyridæ in which the light is intermittent). In a dark room the light appears clear green, inclining to blue; in daylight it is yellowish. The spectrum analysis has not been satisfactorily effected; but the light seems to produce a spectrum wanting half the blue and deficient in the red. An extracted luminous organ will continue to give red light for some hours (for twenty-four hours if kept in moist air). No light-nerves were found, and so far there was no evidence of the luminosity being under control of the will. It is said that in Lampyridæ the will and the nervous system control the light. In Cucuyo the abdominal light at least depends only on the respiratory center, which is in the metathoracic ganglionic mass. The expiration only of the abdomen is active, and the inspiration is the passive act of the abdominal muscles returning to their place of rest. On every such inspiration the air brought by the tracheæ causes the luminous organ to give its bright, steady light. It is manifest that the light depends on a process of oxidation. All experiments, mechanical irritation, chemicals, or electrical stimulus never succeeded in exciting more than the mild cell-light. But a stream of atmospheric air, and especially of oxygen, brought out the brilliant tracheal-light. The gases were introduced through a glass cannula inserted in a stigma. For the continuance of the light both oxygen and moisture are favorable. The luminous process goes hand-in-hand with the production of a greenish-yellow substance which is found diffused in the luminous cells; and this yellow can be fixed. Our author holds that a substance is produced in the protoplasm of the luminous organ, which on contact with oxygen burns and becomes luminous. The ashes produced are rich in phosphoric acid, from which he concludes that there is a burning of some phosphorous body; and thus both in aspect and in nature it corresponds with the light of a lucifer match.—*G. Macloskie.*

THE DISTRIBUTION OF DERIVED PLANT-PIGMENTS IN CERTAIN LARVÆ.—In a paper in the Proc. Roy. Soc. (No. 237, 1885, p. 269), I gave an account of the way in which altered plant-pigments take part in larval coloring. The evidence was chiefly derived from an examination of the strongly-colored blood of many pupæ; but some larvæ were also investigated, and it was found that the green ground color of many species (especially Noctuæ) was due to the derived green pigments dissolved in the blood. At the same time it was argued that in other species (green Sphingidæ, etc.,) the pigments passed from the blood into the hypodermis cells, and so colored the larvæ. This latter conclusion seemed certain, although it had not been experimentally investigated, because I was working at the subject at a time of year when I could only obtain Noctua larvæ. I was therefore uncertain whether the color of the blood assisted in producing any of the ground color in those larvæ in which the color was also segregated in the hypodermis cells. During the past year I investigated the subject in the larva of *S. ocellatus*, and I found that the blood is only very faintly tinged with derived pigments, and that it cannot produce any effect upon the larval appearance until it has been collected in the superficial cells. It is probable that in such larvæ the modified plant-pigments are slowly passing from the digestive tract to the hypodermis cells through the medium of the blood, and that the blood itself at no time contains a large quantity of pigment. Before pupation the pigments are withdrawn from the cells, and are dissolved in the (pupal) blood, which therefore possesses a concentrated solution of all the pigments that have passed through this medium during the whole of larval life, except those which have been destroyed (if any). Such conclusions render it probable that the most complete demonstration of the vegetal origin of the derived pigments will be a matter of great difficulty, for the amount that passes through the digestive tract as the result of any one meal must be very small, and probably even less could be obtained by carrying on artificial digestion outside the body of the larvæ. And this is likely to be the case with the larvæ in which the blood itself retains all the pigments which have passed through the walls of the digestive tract, for in these larvæ it is probable that only a minute quantity passes through as the result of any one meal. Furthermore, the fact that the derived pigment is associated with a proteid in the blood renders it almost certain that the processes of modification and association are the direct results of protoplasmic activity, and not the results of ferments, etc., which have themselves been formed by the latter agency. Hence it is far less likely that artificial digestion could be successfully performed than in the case of higher animals. Nevertheless, there are certain ways in which the problem could be attacked with every prospect of success. (1) There are many larvæ which eject a green fluid from the mouth, and this fluid has the same spectrum as that of the blood (in the instance examined). It is probable that such a solution might be made by artificial digestion. (2) The blood of some large larvæ in which the pigments passed into the hypodermis cells might be investigated at various times after a meal and after fasting, and in this way we might expect to trace corresponding fluctuations in the amount of pigment in the blood, as proved by the spectroscopic examination of equal thicknesses. (3) In the same way the pigments might be examined in newly-hatched larvæ before and also at various times after their first meal, when more extensive fluctuations might be witnessed.—*E. B. Poulton, Trans. Ent. Soc., London, 1886.*

THE FLUID EJECTED BY NOTODONTIAN CATERPILLARS.—This defensive fluid, says Mr. Poulton (Trans. Ent. Soc. London, 1886, 157), as is well known, is ejected from a transversely placed aperture on the ventral surface of the prothorax immediately below the head. He had long known that it was powerfully active, affecting litmus-paper in the most marked manner. During the last summer he found that the fluid causes violent effervescence when allowed to fall upon sodium bicarbonate, and has proved (by the reduction of silver nitrate) that the fluid is formic acid. The smell is also quite characteristic, and affords an indication of the larger proportion of acid present in the secretion. He also states that the freshly-made and moist cocoon of *Dicranura vinula* is powerfully acid to test-paper.

"In September, 1885, I found a few larvæ of *D. furcula* on willow, near Visp, in Switzerland, and I examined them to see if they also would eject a fluid when irritated. It was at once obvious that the aperture was present in the same position as in *D. vinula*, but as the larvæ did not eject any fluid I applied gentle pressure (for this is often necessary in the case of *D. vinula*). To my great surprise a complex form of "gland" was instantly everted through the aperture, consisting of six diverging processes of a light green color, divided into two groups of three each. It will be very interesting to investigate the young stages of *D. vinula* in the light of this observation, for it will then be possible to decide whether the apparatus belonging to the latter is derived from an eversible gland which has ceased to be eversible and has fallen back into the condition with which all such structures must have begun—a simple secretory involution discharging its odoriferous or irritant contents; or whether the arrangement in *D. vinula* is truly ancestral while that of *D. furcula* represents a further advance.

"Since the above was written, I have been informed by Lord Walsingham that a simple prothoracic gland is present in the larva of *Melitæa artemis* and that the structure is everted, and hence becomes very prominent in blown larvæ. Lord Walsingham considered that the secretion was of use to the larva in moistening its food. On looking through the collection of preserved larvæ we also noticed other instances of the gland (*e. g.* in the genus Catocala, etc.), so that it seems probable that the structure will be found commonly in larvæ. Hence it appears that the defensive secretion and modified gland of the genus Dicranura are a specialization of an organ which is probably used for a very different purpose by many other larvæ. Although the gland of *D. vinula* seems to be intermediate between that of *D. furcula* and of other larvæ, I think it probable that the ontogeny of the former larva will show that its gland at one time possessed all the complexity observed in that of *D. furcula*."

[We have observed that the larva of *Lochmæus tessella* Pack., when disturbed, sends out from each side of the body a shower or spray of clear liquid. A hasty examination of living and dead specimens has failed to show us the exact opening, which must be in the lower anterior part of the prothoracic segment.—*A. S. P.*]

PECULIAR SUBCUTANEOUS ORGANS IN THE CATERPILLAR OF CATOCALA.—At the meeting of the Entomological Society of London, for April 7th, Mr. William White exhibited preserved specimens of the larva of two species of Catocala, for the purpose of calling attention to some remarkable processes upon the under side, which seem to have been unrecognized hitherto. He stated that, having lately submitted to a microscopical examination the characters on the under side of lepidopterous larvæ of numerous groups, he found this new character to exist in the case of the Catocalidæ, but in no other family. Upon the lower side of the English species, *C. fraxini*, there are curious markings of a *fleur-de-lis* shape between the legs of the second and third thoracic segments, and a further series of marks of various forms upon the third, fourth, fifth, sixth and seventh abdominal segments. These markings are of a dark mahogany brown color, fading into deep orange all round, and in connection with these there is found to be (when examined with a strong lens) a development of some strange processes of a pocket-like appearance. Upon attempting to insert the point of a fine pin into this pocket he found that they were subcutaneous, and not actually upon the surface as they appeared through the perfectly transparent cuticle to be. The German species of *C. alacta* attains an extended and rather fuller development than *C. fraxini* in bearing the characters upon such segment. The processes vary considerably in grade of development amongst the segments, and he said he had not yet been able to make out their precise order, but he submitted a somewhat rough sketch of the appearance of the abdominal segments of *C. alacta* as shown by a two-inch objective. The first drawing exhibited the internal structure of the dissected portion before the fatty tissues were removed; but little of the processes could be made out from that point of view, and they were more clearly to be seen from the other aspect; also a side view showing the contour of the natural size. The large view of four of the spots presents an idea of the diversity of form in the individual animal, and the two additional sketches show the processes diagrammatically. Mr. White said that the only conclusion he could arrive at respecting them was that they were functional organs of a special nature, and he observed that he should be very glad if any one present could suggest an explanation of any such function, or throw some light upon the question of their purpose. Although the whole of the viscera and other fatty portions of the caterpillar had been squeezed out, these organs were perfectly retained, apparently in their proper form, and it was quite certain that they must fulfill some purpose.

In reply to some observations from Professor Meldola, Mr. White said he had not found any similar organs in any other species, though he had looked well for them; and in reply to Mr. J. Jenner Weir, who suggested that they might act as suckers, he stated that the objection to that explanation was that the skin covering them was perfectly tight. There were in some instances pairs of minute holes which might communicate with the atmosphere, and probably did, but otherwise air was closed from them. There appeared to be a motile closing of the arrangement of tentacles like the clasping together of fingers, but this could not apply to the open continuation of the serrated edge of tentacles above this seam of the lip, which is not unlike the labellum of some orchid.

THE DARKENING OF THE HAIRS OF THE LARVA OF ACRONYCTA BEFORE PUPATION.—During the past summer (1885), I noticed that the long white hairs of this larva become dark, as well as its body, before pupation, when the organism is wandering about to find a place in which to burrow. I then remembered that I had often previously observed the same thing with this larva obtained plentifully upon birch and alder in the near forest. As the larva wanders over the bark, and subsequently burrows in it, the dark color is of great protective use, and is another instance of the utilization of the incidental changes of color before pupation. Previously, during larval, life, the organism rests motionless in a curved position on the under side of the leaf, and the body is almost completely hidden by the long white hairs, and the effect is that of a convex mass of white silk spun on to the under side of the leaf, resembling, in fact, a cocoon, or more probably the convex white egg-case spun by a spider. But such an appearance becomes very much the reverse of protective as soon as the larva moves, especially upon a dark background, and the darkening of the larval body alone would be useless, because the hairs form its most conspicuous feature.—*E. B. Poulton, Trans. Ent. Soc., London, 1886.*

AN EVERSIBLE "GLAND" IN THE LARVA OF ORGYIA.—"I do not know whether this structure has been previously noticed; it is not mentioned in the well-known text-books. The single gland to which I refer is situated in the median dorsal line of the seventh abdominal segment, and it is everted when the larva rolls up on being disturbed. The larval surface close to the lips of the aperture seems to be extremely sensitive to tactile impressions." On reading the foregoing note by Mr. E. B. Poulton in the Transactions of the Entomological Society of London (1886, 159), in reference to the European *O. pudibunda,* I at once turned to several larvæ of *O. leucostigma,* and found, what I had not before observed, that the two coral-red tubercles on the back of the sixth and seventh abdominal segments of that caterpillar are on irritation of the animal plainly eversible; when the caterpillar is at rest they are often one-half as short as when disturbed, and the tip is flattened or deeply hollowed; on irritation the end is everted and becomes rounded and conical; over the upper half are scattered three or four short, fine setæ. While walking, the tubercles are only partly exserted, and the edges are usually in motion, slightly everting and retracting.—*A. S. Packard.*

ENTOMOLOGICAL NEWS.—In the Transactions of the Entomological Society of London for 1886, part II. Mr. E. B. Poulton publishes farther notes on lepidopterous larvæ and pupæ, including an account of the loss of weight in the freshly-formed pupa. This loss is stated to be "immense," but the experiments are not intended to indicate the normal loss of weight in pupæ throughout the quiescent period, although it was necessary for the purpose of comparison, to obtain an approximate average of the rate of normal loss in the species investigated. The normal loss has already been investigated by Meldola.——In the same part (Proceedings) Mr. J. W. Slater read a paper on the genesis of color in insects, in which he maintains in opposition to Grant Allen, that carnivorous insects are not inferior in beauty to flower-and-fruit-haunting groups," and that Mr. Allen's theory of the origin of brilliant coloration is not sustained by an examination of even moderate extent. "We find," says Mr. Slater, "abundance of flower and fruit-haunting species dull and sombre in aspect; an equal abundance of Carnivora and refuse-devourers richly and brilliantly clad; we find groups of species closely simular in color yet quite opposed in their diet, whilst other groups again, alike in their food, signally differ in their coloration."——Dr. Horn's elaborate monograph of the species of Chrysobothris inhabiting the United States, gives the result of a great deal of labor, both with the pencil and pen; the plates are most excellent and rich in details.

ZOÖLOGY.

HAIR-LIKE PROCESSES ON GLANDULAR EPITHELIUM.—Tornier describes in *Arch. f. Mikrosk. Anat.* for June, 1876, hair-like appendages found on the glandular epithelium in the stomach and renal tubules of vertebrates (Amphibia, lizard, rabbit, and mouse). The difficulty of detection, and especially the circumstance that these exist only at the time when the glands are actually secreting, has hitherto prevented their discovery. They differ from cilia by being smaller, not yet detected in constant motion, and in their fugitive character. Doubtless they are somehow connected with the function of secretion.—*G. M.*

ORGANS OF FLIGHT.—M. P. C. Amans sums up an extensive survey of the organs of flight of the animal kingdom by distinguishing two principal types of the machine—the insect and the vertebrate. In the former the principal part is formed by the meso and metathorax; in each segment the endosternum forms the longitudinal axis of the floor; the flanks are sustained by three vertical pieces, and the upper edge by two; the roof of each segment is formed by two parts, which are concave below and without. The frame-work of the wing is formed by six primary nervures and their ramifications, which are alternately related to the sides or the roof; the general form of the wing is that of a biplanar triangle, with the base centripetal and the apex centrifugal. The base is formed of an anterior and a posterior plane, the latter being the more developed; the base of the wings united to the flanks and to the roof of each segment by as many articular pieces as there are nervures. The apparatus of formation is constant, and may be considered as consisting of an anterior piece, which forms a movable pivot, separated by an articular cavity from the fixed pivot. The wing is able to undergo torsion, thanks to the articulations of the anterior and subanterior nervures with their basal terminations. The line of torsion is a nerve which passes through the basal head of the posterior nervure by a special commissure, and through the basal extremity of the proanterior process when it is stretched. The centrifugal extremity of the wing follows in air and during ascent the course of a sinuous line. The wing is never comparable to a simple lever; it is most nearly so in the Pseudoneuroptera; the basilar pieces (including the roof) may be grouped under three sides of a cone of revolution, and the muscles are grouped according to these; the muscles vary greatly in direction, and it is not correct to speak of exclusively vertical or horizontal muscles.